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## Krieg Cortical Kudos 2001

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### The Cortical Explorer Award: Zoltan Nusser

This year the award was presented to Dr Zoltan Nusser for his research on the understanding of the subcellular organization and function of neurotransmitter receptors in the neocortex and hippocampal formation using molecular neuroanatomical and electrophysiological techniques. His talk was entitled 'Organizational Principles of the Subcellular Distribution of Amino Acid Neurotransmitter Receptors'.

Zoltan Nusser was born on October 17, 1968 in Bonyhád,



**Figure 1.** Recipients of the 2001 Krieg Cortical Kudos Awards: Zoltan Nusser (left) and Gyorgy Buzsáki (right), with Charles Ribak, President of the Cajal Club (center).

Hungary. He attended the University of Veterinary Medicine in Budapest, Hungary and graduated in 1992 with a D.V.M. degree. He then traveled to England and earned a D.Phil. at Oxford University in Pharmacology with Dr Peter Somogyi, a former Cortical Discoverer Award winner. Zoltan launched his research career in Peter's laboratory by studying the localization of amino acid neurotransmitter receptors in the hippocampus and cerebellum. His initial studies involved the localization of metabotropic and ionotropic glutamate receptors, and they showed a subsynaptic segregation of these two types. He then embarked on studies involving the localization of different subunits of the GABA<sub>A</sub> receptor using immunogold methods. This high-resolution method provided a new understanding of GABAergic synapses by allowing for the examination of the dynamics of the receptors at these synapses. As one of his nominees, Tamas Freund, wrote, 'Zoltan was able to identify that the major source of postsynaptic response variability at GABAergic synapses is the variation in the number of postsynaptic receptors between distinct synapses'. Thus, he correlated an increase in the size of synaptic responses with the number of receptors by combining physiological recordings with electron microscopy.

This work was quite astonishing. Prior studies suggested that some GABAergic synapses would have a more powerful inhibitory effect because their location was close to the axon hillock where spikes are generated. Thus, the axosomatic and axon initial segment synapses were considered to have a stronger effect than the GABAergic axodendritic synapses. Zoltan provided the first demonstration that GABAergic synapses can have different receptor numbers using postembedding immunogold labeling of different subunits and electron microscopy.

Dr Nusser also conducted postdoctoral work with Dr Somogyi, and this period of time allowed him to continue his studies on the localization of amino acid neurotransmitter receptors. These studies revealed the exclusive extrasynaptic presence of certain ionotropic receptors, the differential expression of postsynaptic AMPA receptors at functionally distinct synapses and the demonstration that certain hippocampal synapses contain few, if any, AMPA-type glutamate receptors. This latter observation provided evidence for the 'silent synapse' hypothesis. While completing his postdoctoral work at Oxford, Zoltan visited the laboratory of Dr Cull-Candy at University College London, where he learned cellular physiology. During this time, he mastered both the technical and theoretical aspects of patch-clamp recordings.

In 1998, Dr Nusser went on to advance his knowledge and expertise in cellular electrophysiology by moving to Dr Istvan Mody's laboratory at UCLA in Los Angeles, CA. Zoltan again made remarkable progress in the field of GABAergic synapses. In this case, he examined the modulation of synaptic GABA<sub>A</sub> receptors by phosphorylation and by several clinically important drugs. Furthermore, he showed that the increased postsynaptic response size at GABAergic synapses following temporal lobe epilepsy using the kindling model was the consequence of the insertion of new GABA<sub>A</sub> receptors into the postsynaptic membrane of dentate gyrus granule cells in the hippocampus.

More recently, Dr Nusser was appointed a Group Leader Research Scientist at the Institute of Experimental Medicine at the Hungarian Academy of Sciences in Budapest, Hungary. In his new independent position, Zoltan will be continuing his pioneering studies on neurotransmitter receptors. He has also been awarded the Glaxo-Wellcome Prize in 1996 for the best D.Phil. thesis in the UK and the Chancellor's Award for

Postdoctoral Research in 2000 for the best research at UCLA performed by a postdoctoral fellow. His future looks bright because he has already garnered many grants for his research laboratory, including ones from the Wellcome Trust, Human Frontiers in Science, James McDonnell Foundation, Boehringer Ingelheim Fond's Award and the Hungarian Science Foundation.

The Krieg Explorer Award honors the extraordinary talent and originality of Zoltan Nusser. In only a few years, he has become a leading authority on the localization of amino acid neurotransmitter receptors. We shall look forward to the contributions that he will make in his very promising career, and anticipate that his studies will continue to add to our understanding of the structure and function of the cerebral cortex.